KING AND TANNER CRAB RESEARCH IN ALASKA:

SEMIANNUAL REPORT FOR

JULY 1, 1993 THROUGH DECEMBER 31, 1993

Submitted To

National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Alaska Fisheries Science Center
Resource Ecology and Fisheries Management Division
7600 Sand Point Say N.E., Building 4
Bin C15700
Seattle, Washington 98115

By

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ADF&G Project Coordinator

Regional Information Report No. 5J94-09
Alaska Department of Fish & Game
Commercial Fisheries Management and Development Division
P.O. Box 25526
Juneau, Alaska 99802-5526

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FORWARD

A federal budget initiative for crab research was funded by the United States Congress in 1992 to address pivotal biological and fishery research to determine optimal management strategies for the lucrative king *(Paralithodes, Lithodes)*, Tanner *(Chionoecetes bairdi)* and snow crab *(Chionoecetes opilio)* fisheries in the waters off the state of Alaska. This initiative, developed by staffs of the Alaska Department of Fish and Game (ADF&G) and National Marine Fisheries Service (NMFS), reflects the shared responsibilities for crab research and fishery management by the state and federal governments. It funds cooperative investigations conducted by crab researchers with ADF&G, NMFS, and universities. The Alaska Department of Fish and Game (ADF&G) was awarded a cooperative agreement by the National Marine Fisheries Service (NMFS) for $299,000 for the period July 1, 1993 through June 30, 1994.

PURPOSE OF DOCUMENT

The purpose of this document is to report on ADF&G's work performed during July 1, 1993 through December 31, 1993. Specifically, the following are addressed: (1) synopsis of long-term research strategy for king, Tanner, and snow crabs; (2) brief description of goals for first-year research that includes five projects; and (3) summary of these projects, work completed through December 31, 1993, and work plans for January 1, 1994 through June 30, 1994. Descriptions of mid-year progress and plans for remainder of year were written by the individual project leaders as noted below. A forthcoming annual report will describe work performed during this latter performance period.

OVERALL LONG-TERM RESEARCH STRATEGY

The Gulf of Alaska (GOA), Aleutian Islands (AI), and Bering Sea (BS) support large commercial fisheries on king, Tanner and snow crabs. Many crab stocks crashed in the 1980s, and 12 fisheries remain closed due to low abundance. Poor success of maintaining productive fisheries over the long-term prompts a re-evaluation of management strategies (Kruse, in press). This cooperative agreement funds research studies to support the development of optimal fishery management strategies for crab stocks in Alaska.

Kruse (1993) proposed a long-term crab research strategy. In sum, it was proposed that wise management of any fishery can only be accomplished by providing answers to four fundamental questions: (1) what are the stocks?, (2) how abundant are they?, (3) what features drive their productivity?, and (4) how should this productivity be best harvested? Although previous crab research provided insights into the answers of some of these questions, serious uncertainties exist that prevent a critical, thorough evaluation of the merits of alternative management strategies. Investigations into four broad areas will provide answers to these pivotal questions.

Stock Structure

Fisheries cannot be managed successfully without understanding the underlying stock structure. Although we have made some good progress (e.g., Seeb et al. 1990a,b) into genetic stock identification of red king crabs *(Paralithodes camtschaticus)*, several key questions remain about structure of BS/AI crab stocks. Some of the most important questions concern the Chionoecetes species complex and golden king crabs *(Lithodes aequispinus)*. Answers to these questions will be used to improve the alignment of fishery management units with genetic stocks.

Stock Assessment

Good stock assessment programs exist for many crab stocks in the BS and GOA, and for some stocks in the AI. Yet, for a few of these stocks, such as BS blue king crabs *(Paralithodes platypus)*, precision is low, for some others (e.g., Adak red king crabs) assessments are too costly to conduct annually, and for still others (e.g., all golden king crab stocks) no assessments have been conducted due to fiscal constraints. Therefore, stock assessment models are needed that integrate multiple years of survey and fishery data into best estimates of abundance. Progress has been made to develop stock estimation models that incorporate multiple years of survey data for red king crabs (e.g., Kruse and Collie 1991). However, more advanced length-based population estimation techniques are needed that can provide for objective evaluation of diverse and sometimes conflicting information from fisheries and surveys. The goal is to better distinguish population changes from survey measurement errors.

Stock Productivity

Unlike most groundfish, herring and salmonids, we lack critical biological information about parameters that regulate productivity of many crab stocks and species. For example, good mortality estimates are lacking for most stocks. Growth of Tanner and snow crabs (including terminal molt of males) is poorly understood. Serious questions exist about size of maturity of snow crabs. Finally, little is known about most life history traits of golden king crabs. Knowledge of these parameters that drive stock productivity is imperative so that harvest rates can be specified to reflect the underlying biological productivity of each species and stock.

Harvest Strategy

Crab harvest strategies may be seriously flawed. Unwittingly, size limits, sex restrictions, and current exploitation rates may adversely affect fishery productivity. In some instances, size limits are based on size of morphological maturity (i.e., males with a large claw) rather than functional maturity (i.e., males that participate in reproduction). Thus, high harvest rates may have eliminated breeding males from stocks managed by size-sex-season regulations. Further, gear designs may promote handling mortality that may

exacerbate stock declines. Management strategies should be matched with stock- and species-specific biological characteristics such as growth, terminal molt phenomena, mortality, size of maturity, and recruitment dynamics. Statistical and simulation studies are needed to evaluate implications of biological traits on harvest strategies.

OVERALL PLAN FOR FIRST YEAR

For the first year, ADF&G is conducting the following five studies: (1) relative roles of fishing, predation and environment on long-term dynamics of Alaskan crab stocks; (2) effects of handling mortality on red king crabs; (3) functional maturity of Tanner crabs; (4) alternative crab harvest strategies; and (5) nearshore crab studies. Projects (1), (2) and (3) are being conducted jointly by ADF&G and the University of Alaska Fairbanks (UAF) through Reimbursable Services Agreements. Cooperating university faculty are located at the School of Fisheries and Ocean Sciences (SFOC) in Fairbanks, the Institute of Marine Science (IMS) in Seward, and the Juneau Center for Fisheries and Ocean Sciences (JCFOS). Project descriptions, mid-year milestones, and future plans follow.

PROJECT 1: LONG-TERM DYNAMICS OF ALASKAN CRAB STOCKS

Dr. Albert V. Tyler, UAF, SFOS

Background and Need

Three decades of catch histories and one to two decades of stock assessments reveal a wide range of crab population trends. To date, most stocks have crashed and not improved (e.g., Kodiak red king crabs), some others have crashed and recovered (e.g., Eastern Bering Sea (EBS) Tanner crabs), and still a few others remain rather healthy despite huge fisheries (e.g., Bering Sea snow crabs). A number of possible causes of these dynamics have been proposed, including anthropogenic and natural causes. Despite wide speculation about the relative roles of various factors on crab populations, the supporting evidence for the alternatives has never been objectively evaluated.

Project Description

The purpose of this multi-year project is to investigate the relative effects of fishing and natural changes on the long-term dynamics of crab populations in Alaskan waters. This will be accomplished through five phases of research: (1) data bases will be compiled relevant to variables that would be implicated in possible causes of change, including: crab spawning stock abundance and recruitment, oceanographic variables, and predator abundance; (2) a workshop will be conducted with biologists and fishery oceanographers to develop a conceptual model of causal mechanisms by which fishing, predation, and oceanography could act on the long-term dynamics of Alaskan crab populations; (3) analyses will be conducted to characterize intrinsic features of the data sets, such as time intervals between successful crab year classes, periods of increased predator

abundance, and years of favorable ocean conditions during crab larval stages; (4) the causal mechanisms will be stated in terms of alternative hypotheses and tested with available data sets by a range of statistical methods; and (5) based on the results the most likely mechanisms will be selected for inclusion in a computer simulation model to fully explore the relative roles of these competing factors on crab populations. The simulation model will be used to identify possible confounding effects of several mechanisms that may interact in sequential and non-linear ways not amenable to standard statistical methods.

First-Year Goals

During the first year of this multi-year project, the following milestones will be accomplished. First, relevant biological and oceanographic data will be procured form ADF&G, NMFS, and the National Oceanic and Atmospheric Administration, and they will be compiled into an electronic data base suitable for the analyses. Second, a workshop will be conducted with biologists and oceanographers to identify possible mechanisms responsible for the observed crab population dynamics. Last, preliminary analyses will be conducted to gain insights into the nature of historic variability in crab populations, their predators, and the environment.

Mid-Year Progress

Data bases for several stocks of red king and Tanner crabs belonging to ADF&G were reviewed for population trends and recruitment survey trends that would lend themselves to analysis of changes in recruitment productivity. King crab stocks of Bristol Bay, Adak, and Kodiak show promise. The limiting factor in the analyses will be the availability of surveys for juveniles over sufficient time periods. A 15 year time period of recruitment records would be necessary for interpretation of trends versus oceanographic variables in view of recent published research on decadal-scale changes in productivity in the ocean (Beamish 1993). Also, records of juvenile abundance cannot be compared to resulting catches from the adult component of the population without a lag of 5 to 8 years, because these large crabs don't enter the fishery until they are 5 to 8 years old. Thus, juvenile abundance can be interpreted against spawning stock via catch-age analysis, but only after a suitable period has elapsed. To date, the only stock that has been identified as having data of sufficient duration as well as year to year consistency of juvenile survey data is the Bristol Bay red king crab stock. Recently, Dr. Jie Zheng developed a length-based model of this stock and found a 19-year relationship between spawning stock size and recruitment (project 4).

Data on Bristol Bay red king crabs were used in this project, Long-Term Dynamics of Alaskan Crab Stocks, to examine decadal changes in productivity for this stock. A sequence of 10 years (1966-1975) had very high recruitment levels, with annual recruitment of greater than 47 million age-7 crabs added to the population. Since that time, however, annual recruitment has been less than 21 million age-7 crabs with the

exception of an intermediate level of recruitment from the 1977 year class (43 million). Dr. Zheng fit a Ricker stock-recruit function to the data from 1968 to 1986, a period wherein both spawning stock size and resulting recruitment could be estimated. He noted that the model would not fit the data well in the early period (1968-1973) because recruitment was higher than predicted. To explain this lack of fit and simultaneously the two periods of productivity, new recruitment hypotheses were developed based on changes in physical oceanography. It is possible that the earlier high productivity period (1966-1975) was related to physical conditions: (1) retention of larvae due to favorable advection; and (2) increased opportunities for high rations due to high primary and secondary productivity. The subsequent low productivity period (1976-1985) should show a change in physical variables that influence these responses. The key years for major physical change would be 1976 and 1977.

Plans for Remainder of Fiscal Year

During the period January through June of this year, time-series data that relate to advection and other physical changes in Bristol Bay and the EBS area will be examined. Appropriate data will be assembled on microcomputer spreadsheet files. Also, a workshop is planned for mid-May with ADF&G, NMFS, and UAF professionals to explore further possible relationships between biological productivity and changes in physical processes in the region.

Benefits of Project

Results from this project will help plan future long-term research into areas of greatest consequence to crab stocks. In particular, we hope to attain a better understanding of the relative roles of fishing, predators, and environmental change on the dynamics of crab stocks. A cognizance of the magnitude of the effects of fishing and reduced spawning biomass on stock productivity will help us later evaluate the merits of alternative crab management strategies within the context of natural variability. Likewise, understanding the strength of relationships between populations of crabs and their predators would help reveal the merits of potential future multi-species or ecosystem management approaches.

PROJECT 2: HANDLING MORTALITY OF RED KING CRABS

Dr. Thomas C. Shirley, UAF, JCFOS

Background and Need

Pots capture male and female crabs of a range of sizes and carapace conditions. Yet, all Alaskan crab fisheries are regulated by size and sex restrictions. As a result, females and small males are discarded. Several lethal and sublethal effects may result from catching, handling and discarding processes.

Handling mortality occurs during fisheries when crabs are killed due to crushing, desiccation, exposure to extreme temperatures, and other factors. Handling mortality has been well documented in crustaceans (Brown and Caputi 1983, 1985; Lyons and Kennedy 1981). Death may be immediate or delayed (Tegelberg 1972; Carls and O'Clair 1990; Stevens 1990). For example, when exposed to cold air, half of the Tanner crab deaths occurred within 24 h and nearly all occurred within 8 days, whereas most red king crab deaths occurred during molting 47-120 days later (Carls and O'Clair 1990). Stress from handling may reduce vigor and predator defenses. King and Tanner crabs that survived exposure to cold air showed reduced vigor (Carls and O'Clair 1990). Lobsters such as *Panulirus marginatus* (Gooding 1985), *P. argus* (Vermeer 1987), and *P. cygnus* (Brown and Caputi 1983) showed reduced tail flipping and drifted limply to the bottom with prolonged air exposure. Experiments revealed that octopi and most fishes only attacked lobsters that did not assume defensive postures (Brown and Caputi 1983).

Sublethal effects of handling include injuries. Appendage loss increases during the fishing season (Shirley and Shirley 1988), and may be a function of air temperature during severe weather (Carls and O'Clair 1990). Although some crabs survive amputation and regenerate lost limbs (e.g., Edwards 1972; MacKay 1942), severely injured crabs may experience reduced growth and initial molt inhibition, followed by shortened intermolt period (Bennett 1973). Likewise, exposure to extreme temperatures inhibits molting of Dungeness crabs, *Cancer magister* (Kondzela and Shirley 1993), depresses feeding rates in Tanner crabs, and reduces growth rates of red king crabs (Carls and O'Clair 1990).

Project Description

This study addresses the effects of sorting and handling by commercial red king crab fishing practices on sublethal stress and survival of sublegal and female red king crabs. Specifically, we are investigating:

1. The effects of handling by commercial red king crab fishing practices on limb damage and loss, and subsequent effects on survival;

2. Whether deck and water impacts result in decreased crab survival;

3. If repeated capture and handling results in additive damage;

4. The causative mechanisms or agents which result in mortality (specifically, can bacterial or protozoan infections be implicated); and

5. Whether damage can be ameliorated by alteration of handling techniques.

Detailed null hypotheses were included in the project proposal described in Kruse (1993).

First-Year Goals

Planned milestones for the first year included: (1) gathering of data on air exposure duration and handling practices by observing commercial crab fisheries; (2) laboratory set-up; and (3) conduct of the initial handling experiments. The remaining work will be completed during the second year of the project.

Mid-Year Progress

Laboratory Experiments. Sublegal male and female red king crabs were collected in Barlow Cove and Auke Bay with commercial and sport crab pots, and handled gently and in a manner to reduce thermal and salinity shock during transport to the laboratory. Within the laboratory, crabs were kept in tanks with flowing seawater from a -30 m intake. Crabs were fed a mixed diet of fish, squid and mussels *ad libitum*. All crabs were acclimated to laboratory conditions for at least two weeks prior to experimentation.

Composition of Treatment Groups. Each crab was individually numbered with a Floy cinch tag attached to the coxae of the dextral third walking leg. Sex, wet weight, carapace length and morphological condition were recorded for each crab. Twenty-seven crabs were used in each experiment: 9 ovigerous females, 9 non-ovigerous females and 9 sublegal males were included in each group. Crab sizes were selected so as to have similar-sized crabs within each treatment, however the placement of crabs into each treatment was determined by random selection. A minimum of 135 crabs of the appropriate sex and size were used in the experiments listed below.

Deck Effect Treatment. Sliding and deck impacts were simulated by treating crabs in a manner mimicking that onboard commercial vessels. Crabs were placed in a crab pot and the pot lowered onto the deck and subsequently tilted at a 45° angle prior to crab removal, in a manner similar to that used in the fishery by pot launchers/retrievers. The impact of the pot on deck was simulated in the laboratory with a pot of similar shape and with heights of the drop also being similar. Subsequent to the deck impact treatment, the crabs were used in either the water impact treatments or in the ramp treatments.

Water Impact Treatment. Crabs were dropped from 3 m heights into seawater onto their dorsal surface, and were subdivided into three groups, with one group being dropped only once, another group being dropped a second time two days later, and a third group dropped three times at 2 day intervals. Another group was returned to the water by means of a slide rather than by impact. All crabs were returned to laboratory holding tanks for examination during a four month holding period.

Control Treatment. A control group received no handling or aerial exposure after the initiation of experiments, other than that used for determining weights and measurements.

Post-Experimental Treatment. Subsequent to treatment, the following were done:

1. Limb loss, wounds and other treatment effects were recorded for each crab immediately after the experimental treatment and weekly thereafter until termination.

2. One day after treatment the Activity Coefficient was determined for each crab. Activity Coefficient (AC, 1000/righting time in seconds) has been found to be a sensitive indicator of general well-being of many marine invertebrates, as an integrated coordination of muscles and sensory perception is required for rapid righting. AC was measured weekly for the first three months.

3. Feeding rates were measured by placing known weights of food (squid) into each crab container and weighing all food remaining in the chamber 24 hours later. Feeding rates were measured weekly for a subset of 9 crabs from each treatment for four months. Controls were conducted for water uptake by food portions.

4. Crabs were examined daily for mortality. Blood smears were made from a subset of 9 crabs from each experimental treatment four months after treatments to examine incidence and intensity of bacteremia using techniques established by the Fish Pathology Lab, Alaska Department of Fish and Game (T. Meyers, ADF&G, personal communication).

5. At the termination of the experiments (four months after treatment), wet weights and anatomical condition were recorded for all crabs.

All laboratory experiments have been conducted, and blood samples collected.

Field Observations. Observations will be made from a variety of sizes of commercial fishing boats to quantify the average impact distance for crabs from the pots onto the vessel deck and the average distance that crabs fall before impacting the water surface when they are returned to the sea. Measurements of crab vessel deck heights above the water line (rail height to deck, rail to water line, false deck to water line, overflow line to water line) are available for commercial crab vessels; measurements were made while the vessels were assembled for crab holding tank inspections (L. Watson, ADF&G, personal communication). We hope to obtain these measurements from vessels participating in the red king crab fishery in the BS, GOA, and Southeast Alaska. Because many crab vessels fished in multiple fisheries (e.g., Tanner, snow, and Dungeness crab fisheries), the data could be collected at the time of holding tank inspections prior to the opening of other fisheries by cross-referencing fishery registration information.

Plans for Remainder of Fiscal Year

All experimental work (laboratory experiments) on the effects of handling on mortality, activity and feeding rates have been completed. Data are being compiled into a data base and analyzed with the statistical methods detailed previously. Remaining milestones to be completed are: (1) summary data (average drop distances, presence or absence of entry ramps) of the commercial red king crab vessels will be collected; (2) results of the laboratory experiments will be presented at an appropriate scientific meeting; and (3) a final report will be the ultimate product of the study. If the data are suitable, a manuscript will be submitted to a peer-reviewed scientific journal.

Benefits of Project

This project will help us understand the potential magnitude of handling mortality on king crab stocks. Because such a large fraction of the crab stocks are handled and returned to the sea, this project will contribute to critical decisions about new crab management strategies. For example, if handling mortalities are low, then gear modifications may be all that is required to minimize adverse effects on crab populations. On the other hand, if handling mortalities are very high, this would enable us reevaluate the effects of fishing on historic stock trends and it could lead us to substantially different management strategies (e.g., fixed harvest rate, both sexes, no size limit) to maintain healthy stocks and sustainable fisheries over the long term.

PROJECT 3: REPRODUCTION OF TANNER CRABS

Dr. A.J. Paul, UAF, IMS

Background and Need

Effects of crab shell condition on reproductive success have not been studied. Crabs that molted within the year have clean carapaces and are called "new shells," whereas those that molted more than a year prior have worn shells often with barnacle growth and are called "old shells." Limited submersible observations suggest that only old shell Tanner crabs participate in breeding (W. Donaldson, ADF&G, Kodiak, personal communication). It is conceivable that male crabs tend to make growth and reproductive tradeoffs. Those that grow tend not to reproduce, whereas those that mate tend not to grow. Studies are required to test this hypothesis. A more detailed background for this study was provided by Kruse (1993).

Project Description. This study addresses important, management-related questions about the reproductive biology of Tanner crabs. An ongoing study by Dr. A.J. Paul of the University of Alaska funded by Alaska Sea Grant is addressing the concept of terminal molt and its relationship to maturity state. The additional work, reported here, complements this ongoing study by also addressing questions concerning effects of shell

condition on reproductive success. Specifically, the proposed new research would address the following hypotheses:

H_{01}: Similar-sized new shell and old shell Tanner crab males are equally likely to mate with multiparous females; and

H_{02}: Similar-sized new shell and old shell Tanner crab males are capable of mating with an equal number of females.

First-Year Goals

This study will be completed in one year. Milestones will include capture of Tanner crabs for study, acclimation to laboratory conditions, conduct breeding experiments, analyze results, and completion of a report on findings.

Mid-Year Progress

To date three collections of Tanner crabs for these experiments have been made by ADF&G biologists: 150 multiparous females from Kachemak Bay, and 150 males and 150 females from the vicinity of Kodiak Island. These crabs are being held in captivity at the Seward laboratory until the breeding season.

Plans for Remainder of Fiscal Year

The experiments will be conducted during April and May which corresponds to the time of year when most multiparous Tanner crabs mate. A report on the outcome of the experiments will be submitted in July 1994.

Benefits of Project

Coupled to an on-going study by Dr. Paul, this project will determine requisite attributes (size and shell condition) of functionally mature male Tanner crabs. Results will be integrated with previous field collections of mating pairs by submersible (Stevens et al. 1993) and with new field collections of mating pairs from shallow waters around Kodiak Island made by SCUBA divers associated with project 5 (Nearshore Crab Studies). With a new understanding of what constitutes mature male Tanner crabs, size limits can be adjusted accordingly to maintain biological conservation objectives of fishery management plans. Also, this information will help to define spawning biomass for studies on crab population dynamics (project 1) and analysis of management strategies (project 4).

PROJECT 4: CRAB MANAGEMENT STRATEGIES

Dr. Jie Zheng, ADF&G

Background

Biological production parameters are needed to determine optimal management strategies and to estimate fishery yield models for the king and Tanner crab fisheries off the coast of Alaska. Although analyzed for inseason management decisions, comprehensive analyses have not been conducted on relative abundance, shell condition, sex ratios, and commercial catch data. For most stocks, the common biological and reference points, such as $F_{0.1}$, yield per recruit, optimum yield, and stock-recruit relationships have not been computed. Utility of fishery thresholds and alternative harvest rates have not been thoroughly evaluated either. Uncertainties in crab stock productivity jeopardize the long-term viability of fisheries, given historic vulnerability of crab stocks to collapse.

Project Description

ADF&G will conduct quantitative analyses of existing abundance, biological, and fisheries data and will conduct simulation modelling to develop optimal harvest policies for king and Tanner crab fisheries. Data analyses will focus on information germane to harvest policy: optimal thresholds, biological reference points, natural and handling mortality, size limits, stock and recruitment relationships, effects of fishing on growth and reproductive success, sustainable yields, and molting seasonality (fishing seasons).

First-Year Goals

Initial analyses will focus on stock-recruit relationships, length-based population models, and the utility of thresholds and harvest rates to optimize the trade offs between high yield and low variability of yield.

Mid-Year Progress

Work completed to date focused on literature review, data collection, construction of length-based population models and parameter estimation, and simulation study on optimal thresholds. Literature on biology, population dynamics, stock assessment, and fisheries management for red king crabs and Tanner crabs have been reviewed, and some important results from past studies have been summarized. Literature review for blue king crabs is being conducted and will be finished in the next two months.

The historical NMFS trawl survey data for Bristol Bay red king crabs, EBS Tanner crabs and blue king crabs have been obtained from NMFS. The simple "area-swept" method was used to estimate the crab abundances for these crab stocks, and the estimated abundances were compared to those generated by NMFS each year. The catch data for

Bristol Bay red king crabs and EBS Tanner crabs were compiled from ADF&G and the literature. The growth and mortality data were derived from the literature.

Length-based population models have been constructed for Bristol Bay red king crabs and EBS Tanner crabs. Population parameters have been estimated for Bristol Bay red king crabs, and preliminary parameter estimation has been conducted for EBS Tanner crabs. Simulations were conducted to evaluate the optimal threshold levels and harvest rates for Bristol Bay red king crabs.

Plans for Remainder of Fiscal Year

Two manuscripts are being prepared: one on length-based population models and stock-recruitment relationships for Bristol Bay red king crabs, and another on optimal thresholds and harvest rates for Bristol Bay red king crabs. It is anticipated that these two manuscripts will go through internal review, and should be readied for journal publication prior to the completion of this fiscal year.

PROJECT 5: NEARSHORE CRAB STUDIES

S. Forrest Blau, ADF&G

Background

Although computer simulation modelling and laboratory studies are effective methods for answering an array of management-related questions, there remains a vital role for field studies. For example, field studies collect the data on growth, mortality, and recruitment used in fishery production models. Also, because of potential for laboratory effects, field studies are important to ground-truth laboratory findings on, say, size of functional maturity. Unfortunately, high costs of vessel charters are often prohibitive to conducting field studies in Alaska.

Project Description

This project represents a low cost alternative to expensive at-sea crab studies by making use of an existing ADF&G program and the proximity of king and Tanner crab populations to the Kodiak regional office. This nearshore crab research project addresses three primary objectives, namely to: (1) gather new information on mating pairs of Tanner crabs in the shallow subtidal areas to complement laboratory studies by Dr. Paul (project 3) and ongoing submersible studies in depths of 500 feet in Chiniak Bay, Alaska (Stevens et al. 1993); (2) study settling dates and density dependent mortality among post-larval red king crabs that recruit to artificial collectors; and (3) deploy, maintain, and retrieve underwater thermographs for use in studies of crab behavior, abundance, and movements.

Mid-Year Progress

The bid award to construct a 26' aluminum skiff went to Edgeweld Incorporated of Kodiak. Construction of the aluminum skiff began February 1, 1994 and is to be completed by March 1, 1994. The skiff features a small cabin just aft of the bow and a 4' x 4' hold, level with the deck, for storing/studying live crab in seawater, or for storing gear. All major components of the skiff and trailer have been ordered or are out to bid including: radar, video sounder, 150 hp outboard with hydraulic steering, global positioning system (GPS) receiver, 11 hp engine and a pump to run a crab block for pulling pots.

Plans for Remainder of Fiscal Year

The skiff should be operational by the end of March when ADF&G biologists will use it to monitor artificial collectors in Chiniak Bay, Kodiak Island. Young-of-year red king crabs collected from these collectors will be assessed in an ongoing attempt to relate the number of settling crabs to subsequent recruitment to the fishery five or more years later. Further, additional collectors will be set at adjacent shallow water sites in Chiniak Bay to better determine the depth distribution of settling young-of-the-year crabs. The gear at these sites will be set and retrieved using the skiff.

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